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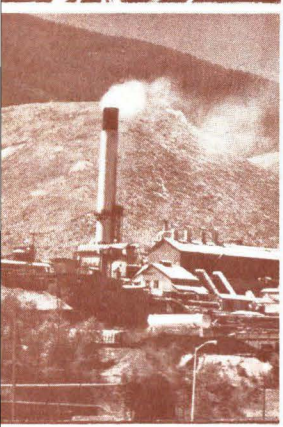

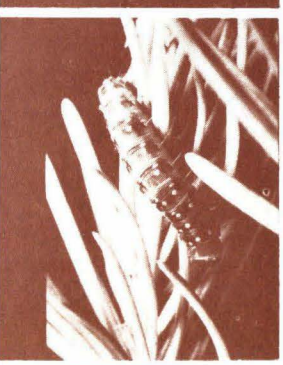

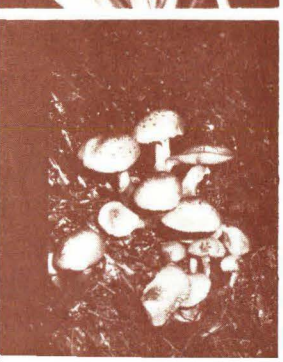

FOREST ENVIRONMENTAL PROTECTION

USDA · FOREST SERVICE · NORTHERN REGION
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STATUS OF MOUNTAIN PINE BEETLE INFESTATIONS YELLOWSTONE NATIONAL PARK, WYOMING, 1973

by

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ABSTRACT

The mountain pine beetle infestation has been epidemic in lodgepole pine in Yellowstone National Park since 1966. Infestation boundaries have advanced steadily northward and eastward. The infestation now encompasses nearly one-half of the total Park area. Surveys indicate a decline in tree mortality the last 2 years. In 1970, an average of 18.9 lodgepole pine was killed per acre. In 1971, 19.0 were killed per acre. In 1972 and 1973, these figures declined to 16.7 and 6.6 trees per acre respectively. Average diameter of attacked trees has decreased from 12.0 inches d.b.h. in 1971 to 10.0 inches d.b.h. in 1973. A decrease in number of infested trees occurred in older infestation centers in the southwest corner of the Park due to depletion of available hosts.

INTRODUCTION

Mountain pine beetle, *Dendroctonus ponderosae* Hopk., has caused extensive tree mortality in Yellowstone National Park the past 30 years. The last reported outbreak began in the northwest corner of the Park in 1931 and subsided 16 years later (Gibson, 1947).

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ROCKY MOUNTAIN STATION

The recent infestation extended into Yellowstone National Park from adjoining infested National Forest lands in Idaho and developed to epidemic levels in lodgepole pine stands in the Cave Falls-Bechler River area in 1966. The trend of the infestation has been toward the north and east since 1966. Although a reduction in actual tree mortality has occurred the last 2 years, the infestation continues to advance and now covers nearly 50 percent of the Park.

By 1973, the forefront of the mountain pine beetle infestation had advanced along the west boundary of the Park north to Grayling Creek, southward through Gibbon Geyser Basin and southeast to the north end of Yellowstone Lake (Fig. 1).

Infestation intensity decreased substantially in the Park's southwest corner where heavy losses have occurred since 1966, and where few susceptible sized trees remain to be attacked. Most severe infestation levels now occur northeast of Pitchstone Plateau and around Heart Lake. The total infestation now exceeds 500,000 acres.

METHODS

Ground surveys to inventory losses resulting from the mountain pine beetle in Yellowstone National Park have been conducted since 1966 by National Park Service personnel. During 1973 seventeen square-mile blocks were selected to measure volume loss and number of trees killed per acre. Within each 640-acre block, variable plots were located at 5-chain intervals. Three lines forming an equilateral triangle with sides 1 mile long were run in each section.

Wedge prisms (BAF-10) were used to determine trees per plot. Trees within plot boundaries were recorded by species, diameter at breast height (d.b.h.), and total height. Attacked and beetle-free trees were recorded using the following categories:

0 - green, uninfested.
1 - 1973 attacks; green foliage, brood present.
2 - 1972 attack; red foliage, brood emerged.

Data were analyzed using a modified Region 1 ADP sale cruise program. Number of infested trees, infested trees per acre, volume loss per year, and residual green stand were summarized.

RESULTS

In areas surveyed, the coniferous stand is approximately 76 percent lodgepole pine, *Pinus contorta* Douglas; 12 percent alpine fir, *Abies lasiocarpa* (Hopk.); 7 percent Englemann spruce *Picea engelmanni* Parry; and 4 percent white bark pine, *Pinus albicaulis* Engelmann. A few

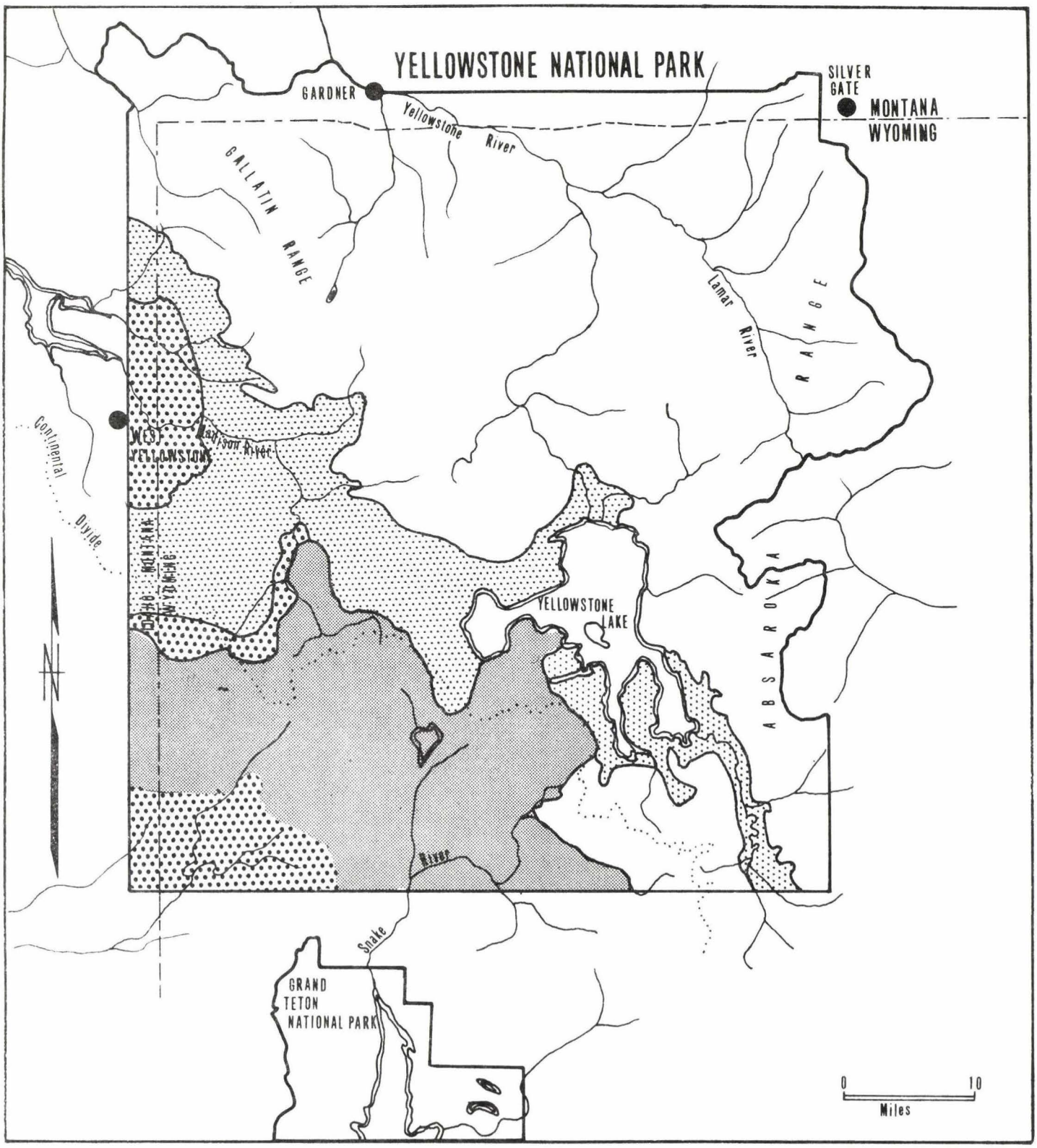

Figure 1. Mountain Pine Beetle Infestation Levels, Yellowstone National Park

light medium heavy

Douglas-fir, *Pseudotsuga menziesii* var *glauca* (Beissen.); and aspen, *Populus tremuloides* Michx., occur in the stand. Ecological habitat types vary from *Pseudotsuga menziesii/Calamagrostis rubescens* at the lower elevations (ca 6,100 feet) to *Abies lasiocarpa/Vaccinium* spp. at higher elevations (ca 8,900 feet).

A total of 17 areas including 10,880 acres were surveyed during 1973. Nearly one-half of this infested area was also surveyed during the preceding 3 years providing comparison data over a 4-year period (Berg and McGregor 1972, McGregor and Berg 1973). Estimated lodgepole pine mortality and volume loss data for 1972-73 are shown in tables 1 and 2. The highest level of infestation occurred at Mount Ash where 16.5 lodgepole pine were infested per acre in 1973; this compares with a high of 25.1 infested trees per acre for the same area in 1970. The Bechler Canyon block ranked second highest with 15.3 infested trees per acre as compared to a high of 38.0 trees in 1970. Although these figures illustrate a downward trend in mortality, the epidemic persists. During 1972-73, 156,675 lodgepole pine trees with a merchantable volume of 14,545,213 board feet were killed in survey areas. An additional 1,990 whitebark pine were killed in 1973 with a volume loss of 62,750 board feet.

An average of 18.9 lodgepole pine was killed per acre in 1970, 19.0 in 1971, 16.7 in 1972, and 6.6 in 1973. The average d.b.h. of infested lodgepole pines was 12.0 inches in 1971, 11 inches in 1972, and 10 inches in 1973. In 1973, 79 percent of the trees killed were 10 inches d.b.h. and larger in size; in 1972, 78 percent were 10 inches d.b.h. and larger. Of the remaining green lodgepole pine approximately 42 percent are 10 inches d.b.h. and larger. The average d.b.h. of the remaining green stand of lodgepole pines has been reduced from 8.0 inches in 1971 to 6.0 inches in 1972 and 4.0 inches in 1973. Approximately 5 percent of the lodgepole pine stand was killed in 1972 and another 2 percent in 1973. Percent tree mortality by diameter class is shown in Table 3.

DISCUSSION

The current outbreak of mountain pine beetle in Yellowstone National Park is part of a general infestation that started on the Targhee National Forest, intensified, and extended into Yellowstone National Park in 1966.

From 1966 through 1970, tree killing progressed at a rapid rate with considerable losses. In 1971, a decline in tree mortality began. Depletion of susceptible host is probably the main reason for the decline. This was particularly true in the Bechler Canyon area where infestation levels have declined substantially due to depletion of large diameter trees. Prior to this decline, average d.b.h. of infested trees throughout the area was 12 inches; in 1972 this had been lowered to 11 inches, and by 1973 trees 10 inches in d.b.h. were being attacked.

Table 1.--Estimated lodgepole pine mortality in survey areas due to mountain pine beetle, Yellowstone National Park, 1970-1973

Area surveyed	Acres surveyed				Infested trees/acre				Total trees killed			
	1970	1971	1972	1973	1970	1971	1972	1973	1970	1971	1972	1973
Snow Butte (1201)	--	640	640	640	32.2	6.8	14.2	11.9	20,608	4,352	9,088	7,643
Phantom Trail (1204)	--	640	640	640	6.8	16.9	7.1	6.0	4,352	10,816	4,544	3,869
Mount Ash (1206)	--	640	640	640	25.1	24.1	13.1	16.5	16,064	15,424	8,384	10,561
Beula (1209)	--	640	640	640	27.6	35.8	11.7	7.9	17,664	22,912	7,488	5,071
Harebell (1301)	--	--	--	640	--	--	1.8	10.4	--	--	1,150	6,635
Fox Creek (1302)	--	--	--	640	--	--	.7	.8	--	--	444	519
Buffalo Lake (2201)	--	640	640	640	.9	0	24.0	9.5	576	0	15,360	6,060
Bechler Canyon (2203)	--	640	640	640	38.0	28.5	27.0	15.3	24,320	18,240	17,280	9,814
Shoshone Cabin (3201)	--	640	640	640	1.4	20.8	8.1	6.8	896	13,312	5,184	4,323
Lone Star Geyser (3301)	--	--	--	640	--	--	5.4	2.9	--	--	3,440	1,828
Heart Lake (2301)	--	--	--	640	--	--	10.2	9.7	--	--	6,558	6,237
Rabbit Lake (4302)	--	--	--	640	--	--	2.0	0	--	--	1,259	0
Arnica Creek (4303)	--	--	--	640	--	--	1.9	3.1	--	--	1,190	1,959
Summit Lake (4304)	--	--	--	640	--	--	3.6	9.1	--	--	2,287	5,812
Nezperce (5311)	--	--	--	640	--	--	.3	.5	--	--	172	296
Fountain (5312)	--	--	--	640	--	--	0	0	--	--	0	0
Duck Creek (7306)	--	--	--	640	--	--	2.4	1.1	--	--	1,546	674
Average or Total	--	4,480	4,480	10,880	18.9	19.0	16.7	6.6	84,480	85,056	85,374	71,301
Average d.b.h.					--	12.0	11.0	10.0				
GRAND TOTAL											326,211	

Table 2.--Estimated lodgepole pine volume loss in survey areas caused by mountain pine beetle, Yellowstone National Park, 1972-1973.

Area surveyed	Infested vol/acre(bd.ft.)		Total volume loss(bd.ft.)	
	1972	1973	1972	1973
Snow Butte (1201)	1,433	241	917,337	154,489
Phantom Trail (1204)	1,668	569	1,067,648	363,854
Mount Ash (1206)	2,402	544	1,537,285	348,452
Beulah (1209)	1,326	992	848,662	634,593
Harebell (1301)	452	1,693	289,474	1,083,778
Fox Creek (1302)	189	221	120,722	141,723
Buffalo Lake (2201)	1,160	547	742,606	349,976
Bechler Canyon (2203)	4,927	1,060	3,152,963	678,704
Shoshone Lake (3201)	479	391	306,875	250,518
Lone Star Geyser (3301)	264	106	169,040	67,970
Heart Lake (2301)	495	362	316,985	231,807
Rabbit Creek (4302)	57	0	36,221	0
Arnica Creek (4303)	68	155	43,282	99,248
Summit Lake (4304)	184	364	117,747	233,132
Nezperce (5311)	64	63	41,168	40,464
Fountain (5312)	0	0	0	0
Duck Creek (7306)	161	86	103,354	55,135
Total			9,811,370	4,733,843
Grand Total				14,545,213

Table 3.--Percent lodgepole pine killed by diameter class, Yellowstone National Park study areas, 1972-73

Item	D.b.h. in inches											
	<6	6	8	10	12	14	16	18	20	22	24	>24
Remaining green trees	19.30	19.57	19.14	14.56	13.46	4.86	3.93	2.54	1.54	0.26	0.45	0.26
1973	.56	5.98	14.36	14.66	24.54	12.57	14.07	5.38	4.78	.88	1.49	.59
1972	1.91	6.02	13.97	21.14	22.94	11.27	12.81	3.70	3.19	1.91	.64	.37

It has been shown that during the course of a mountain pine beetle outbreak, the larger diameter trees are infested and killed first each year as well as during the course of an infestation (Cole and Amman 1969). Food is probably the most limiting regulatory factor for survival of mountain pine beetle broods in these trees. Although phloem-tree diameter relations are variable, large diameter trees generally contain the thickest phloem (most food) and small diameter trees the thinnest phloem. Also large trees usually produce more beetles per unit of bark than do small trees and only infested trees 12 inches d.b.h. and greater produce more beetles than they absorb (Cole and Amman, 1969).

Given this information, the mountain pine beetle infestation will probably continue to decline since the majority of larger diameter trees have been killed. If the infestation continues to follow the same pattern, however, it can be expected to infest mature and over-mature stands in the northern portions of the Park.

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